

(IRIS &) Hinode Operation Plan (IHOP) Guidance

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1 IHOP PLANNING GUIDES

- NASA Instructions: <https://hinode.msfc.nasa.gov/hops.html>
 - HOP list and coordination calendar available from this link.
- JAXA Instructions: <http://www.isas.jaxa.jp/home/solar/guidance/index.html>
 - Lead reference with different format.

1.1 Contact(s) for general IHOP questions

Contacts for each instrument provided below encourage you to contact them for help with planning the details of the observations.

- Sabrina Savage – [sabrina.savage \[at\] nasa.gov](mailto:sabrina.savage@nasa.gov)
- Tetsuya Watanabe – [watanabe \[at\] uvlab.mtk.nao.ac.jp](mailto:watanabe@uvlab.mtk.nao.ac.jp)
- IRIS – Bart De Pontieu – [bdp \[at\] lmsal.com](mailto:bdp@lmsal.com)

1.2 Note on IRIS Coordination

The Hinode Science Working Group has decided to prioritize and encourages proposals for so-called IRIS/Hinode Operations Plans (IHOPs). Requests and details of these operations plans are similar to normal HOPs except that they include requests for observations from the Interface Region Imaging Spectrograph (IRIS). IRIS is a small explorer satellite, built and operated for NASA by Lockheed Martin Solar & Astrophysics Laboratory in Palo Alto, CA. IRIS takes both images and spectra of the solar photosphere, chromosphere, transition region and corona at high spatial, temporal and spectral resolution, providing datasets that are highly compatible with Hinode's suite of instruments.

Details on IRIS observing capabilities are provided in § 3.4. Coordination with IRIS, through IHOPs, will be performed throughout the year, but will be very high priority outside of their respective eclipse seasons (see § 2.3.2).

2 SUBMITTING A PROPOSAL

2.1 How to Submit a Proposal

Use the following form to submit an IHOP proposal. **If planning IRIS coordination, also separately contact Bart De Pontieu (bdp[at]msal.com).**

- **IHOP submission form:** https://docs.google.com/forms/d/e/1FAIpQLSeQ0138aMvCXFD-MJu_JX1-ek-cV2qcAy6AI6hWgAHyGGNXNQ/viewform

2.2 When to Submit a Proposal

The Hinode Science Scheduling Committee, along with an IRIS representative, meets once per month (typically in the second half of the month). It is critical that proposals are submitted well in advance. **Approximately two months prior to observations is highly recommended.**

2.3 Timing of Observations

2.3.1 Operational Modes

Hinode operates in two Operational Modes throughout the course of the year. Note that because the spacecraft pointing is rarely changed during Focused Mode operations described below, coordination with other observatories is significantly reduced. However, long-term observational campaigns that do not require multiple pointings are optimal for this operational configuration.

- **Normal Mode:** Hinode uploads a sequence of commands (i.e., a timeline) three times per week (Tuesday, Thursday, Saturday).
- **Focused Mode:** Hinode uploads a timeline only once per week (Tuesday).
 - Scheduled twice per year during Hinode and IRIS eclipse seasons (see below) to reduce science impact.
 - For each eclipse period, Focused Mode is implemented for a total of nine weeks with a week of Normal Mode between three week sets (for calibration purposes).
 - **Focused Mode Calendar:** <https://hinode.msfc.nasa.gov/status.html>

Due to the timing of the uploads, the Hinode instrument operation planners need adequate advanced notice of any coordinated campaign targets. It is critical that proposal PIs begin communication with the Hinode instrument teams at least 5 days prior to scheduled observations to relay target information. Depending on the day of the week of the observations during Normal Mode operations, final target coordinates may need to be selected at least 3 days in advance. During Focused Mode, selections must be conveyed the weekend before the Tuesday weekly upload. **Targets cannot be changed once a timeline is uploaded.**

2.3.2 Eclipse Seasons

During the eclipse seasons, the Earth blocks the satellite's view of the Sun approximately once per orbit.

- **Hinode:** ~May through August
- **IRIS:** ~November through February
- **Orbital period (for both):** ~100 minutes
- **Eclipse duration:** Up to ~30 minutes

2.3.3 SAA & HLA interruptions

As the Earth rotates, the satellite orbit drifts with respect to the Earth to maintain a sun-synchronous view along the day/night terminator. As a consequence, both Hinode and IRIS periodically fly through the South Atlantic and High Latitude Anomalies, resulting in high levels of cosmic rays reaching the detectors. Hinode pauses observing during these short periods of up to ~20 minutes (variable).

For campaigns requiring uninterrupted observations, the "SAA-free period" can be requested in the IHOP proposal, which lasts up to ~4 hours around 12:00 UT.

3 INSTRUMENT GUIDANCE

Capabilities, resolutions, optical layouts, etc. can be found from the links within the following instrument overview site as well as in the instrument papers noted in the following subsections.

- Overview: <https://hinode.msfc.nasa.gov/instruments.html>

Be sure to read the notes in the telemetry section (§ 3.5).

3.1 SOT – Solar Optical Telescope

Planning contact(s):

- Ted Tarbell – tarbell [at] lmsal.com
- Takashi Sekii – sekii [at] solar.mtk.nao.ac.jp
- Dick Shine – shine [at] lmsal.com

Capabilities:

Note: The filtergram (FG-NFI/BFI) camera is no longer available as of Feb. 2016.

- **SOT Instrument Paper:** https://link.springer.com/chapter/10.1007/978-0-387-88739-5_8

Operations Planning:

Note: The following information is being updated to reflect the loss of the filtergram (FG-NFI/BFI) functionality. Contact someone on the list above for guidance on specific observation sequences, if needed.

- **Mission Page:** <http://sot.lmsal.com/>
- **SOT Observations Planning:** <http://hinode.nao.ac.jp/en/for-researchers/instruments/sot/operation/>

3.2 XRT – X-Ray Telescope

Planning contact(s):

- Katharine Reeves – kreeves [at] cfa.harvard.edu
- Ed DeLuca – edeluca [at] cfa.harvard.edu
- Tara Sakao – sakao.taro [at] isas.jaxa.jp

Capabilities:

Note: The Ti-poly and C-poly are no longer in use due to light leakage through the front entrance filter. Al-poly, Thin-Al, and Thin-Be are good substitutes.

- **Mission Page:** <http://xrt.cfa.harvard.edu/>
- **XRT Instrument Paper:** <http://adsabs.harvard.edu/abs/2007SoPh..243...63G>

Operations Planning:

- **Monitor:** With one filter at a 384x384 FOV, we can run at a minute cadence all day. A second image can be added (either the same filter with a different exposure time for added dynamic range, or a different filter for temperature coverage), but tradeoffs will have to be made in either cadence or duration of the observation.
- **Coronal Mass Ejections:** CME Watch is full disk 4x4 images. Can be done with long/short pairs for dynamic range, or two different filters for temperature coverage. Typically run at a 3-5 minute cadence, but can be done faster during periods of higher telemetry.
- **Active Region:** Typical AR programs: 1) one-filter, high cadence 2) two filter for temperature coverage. Can be 384x384 or 512x512.
- **High Cadence:** XRT can take images in one filter as fast as 2 seconds. Can only be done with small fields of view (512x512 or less), and for limited periods of time (due to telemetry).
- **Synoptics:** Daily synoptics are taken twice a day. Full sun, binned 2x2. Usually three filters, but seven filter synoptics are taken twice a week.
- **Special Full Disk:** Full FOV, full resolution images are expensive in terms of telemetry, but can be taken on a limited basis for special observations (i.e., eclipses).

3.3 EIS – EUV Imaging Spectrometer (EIS)

Planning contact(s):

- Len Culhane – j.culhane [at] ucl.ac.uk
- Tetsuya Watanabe – watanabe [at] uvlab.mtk.nao.ac.jp
- John Mariska – jtmariska [at] gmail.com
- Harry Warren – harry.warren [at] nrl.navy.mil

Capabilities:

- **Mission Page:** <http://solarb.mssl.ucl.ac.uk/SolarB/Solar-B.jsp>
- **EIS Instrument Paper:** <http://adsabs.harvard.edu/abs/2007SoPh..243...19C>

Operations Planning:

For observers unfamiliar with the existing EIS studies, use the widget [eis_filter_studies](#) to search for a study that meets your needs. If something doesn't exist, it is easy to make a new study or to ask someone for help in making the study. The following site provides a good starting point for scouting out appropriate studies.

- **EIS Observations Planning:** <http://solarb.mssl.ucl.ac.uk/SolarB/estudylist.jsp>

3.4 IRIS – Interface Region Imaging Spectrograph

Planning contact(s):

- Bart De Pontieu – bdp [at] lmsal.com

Capabilities:

- **Mission Page:** <https://iris.lmsal.com/mission.html>
- **IRIS Instrument Paper:** <https://link.springer.com/article/10.1007/s11207-014-0485-y>
 - Direct PDF link: https://www.lmsal.com/iris_science/doc?cmd=dcur&proj_num=IS0196&file_type=pdf

Operations Planning:

- **IRIS Observations Planning:**
 - Full list of documentation: <https://iris.lmsal.com/documents.html>
 - Coordinated Observations Document with OBS.ID selection instructions: https://www.lmsal.com/iris_science/doc?cmd=dcur&proj_num=IS0301&file_type=pdf

3.5 Telemetry Notes

The telemetry used by the FG has been redistributed amongst the SOT Spectro-polarimeter (SP), XRT, and EIS. New studies that take advantage of the increased telemetry are highly encouraged. Examples include:

- Higher cadence
- Larger FOV
- Full-resolution normal SOT-SP maps
- Increased EIS line list
- **Limb studies:** SOT-SP is unable to observe near the limb. During limb observations, both XRT and EIS have substantially increased telemetry.

4 FINDING DATA

The instrument teams maintain their own data archives. A consolidated site is provided below, along with a search tool helping to find IRIS & Hinode coordinated data.

- **Data Archives:** https://hinode.msfc.nasa.gov/data_archive.html
- **IRIS/Hinode Search Tool:** <http://www.lmsal.com/heksearch/>
- **(j)Helioviewer:** XRT data is now available via the j(helioviewer)!

5 PUBLISHING

Please use the following acknowledgement statement when using Hinode data and add HOP information, if applicable.

- **Hinode Publication Policy:** <https://hinode.msfc.nasa.gov/data.html>

6 FOLLOW-UP!

The Hinode team tracks the successful (and unsuccessful) usage of the data and productivity of the coordinations in order to inform funding agencies. Please provide your productivity information via the following form:

- **IHOP Productivity Form:** <https://docs.google.com/forms/d/e/1FAIpQLScK1kKGBZcx45reexqyVJsMkRm0BbpifZ0ImpkrQtHINfgjsg/viewform>